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1525 U.S. PT
09/491933
01/26/00

Transmitted herewith for filing is the patent application of:

Inventor: Pascal MELLOTT

For: SIGNAL AMPLIFICATION CIRCUIT AND PROCESS FOR NEUTRALIZING NOISE FROM A POWER SUPPLY VOLTAGE

Enclosed are:

- ☒ Patent Application: 8 pages, 4 claims.
- ☒ 2 sheet of drawings.
- ☒ An assignment of the invention to STMicroelectronics S.A.
- ☒ A declaration and power of attorney.
- ☒ A Preliminary Amendment.
- ☒ Submission of Proposed Drawing Modification.
- ☒ A certified copy of French application No. 99 00946.

The filing fee has been calculated according to the Preliminary Amendment filed herewith as shown below:

	(Col. 1)		(Col. 2)		SMALL ENTITY		LARGE ENTITY	
	# FILED		# EXTRA		RATE	FEE	RATE	FEE
FOR:						\$ 345	OR	\$ 690
BASIC FEE							OR	
TOTAL CLAIMS	16	-20	-0-		X 9	\$	OR	X 18 \$ -0-
INDEP CLAIMS	5	-3	2		X 39	\$	OR	X 78 \$ 156
[] MULTIPLE DEPENDENT CLAIM PRESENTED					+	\$	OR	
* If the difference in Col. 1 is less than "0", enter "0" in Col. 2.					TOTAL	\$ --	TOTAL	\$ 846

☒ Enclosed is a check in the amount of \$ 846.00 to cover:
☒ Filing Fee

☒ Enclosed is a check in the amount of \$ 40.00 to cover:
☒ Recording Assignment

☒ The Commissioner is authorized to charge or credit any discrepancies in fee amounts to Deposit Account No. 01-0484.

PLEASE DIRECT ALL CORRESPONDENCE TO:

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PAUL J. DITMYER
Reg. No. 40, 455
(407) 841-2330

January 26, 2000
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
MELLOT

Serial No. Not Yet Assigned

Filing Date: Herewith

For: **SIGNAL AMPLIFICATION CIRCUIT
AND PROCESS FOR NEUTRALIZING
NOISE FROM A POWER SUPPLY
VOLTAGE**

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PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to the calculation of fees and examination of
the present application, please enter the amendments and
remarks set out below.

In the Drawings:

Submitted herewith is a request for a proposed
drawing modification to label FIG. 1 prior art as indicated in
red ink.

In the Claims:

Please cancel Claims 1-4.

Please add new Claims 5-20.

5. A signal amplification circuit comprising:

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Serial No. **Not Yet Assigned**
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a differential amplifier having a first input for receiving a reference voltage and second input for receiving a signal to be amplified;

a biasing resistor connected between the first and second inputs; and

a signal resistor, through which a current passes, connected between the first and second inputs, the variations of the current corresponding to the signal to be amplified.

6. A circuit according to Claim 5, wherein the signal resistor comprises a pull-up resistor for initializing an operating state of a microphone, and wherein the second input of the differential amplifier is for connection to a microphone output.

7. A circuit according to Claim 5, further comprising an impedance matching stage having an input for receiving the reference voltage and an output connected to the first input of the differential amplifier.

8. An amplifier circuit comprising:

a differential amplifier having a first input for receiving a reference voltage and second input for receiving a signal to be amplified;

a biasing resistor connected between the first and second inputs; and

a signal resistor connected between the first and second inputs and in parallel to the biasing resistor.

In re Patent Application of
MELLOT
Serial No. **Not Yet Assigned**
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9. An amplifier circuit according to Claim 8, wherein the variations of a current passing through the signal resistor correspond to the signal to be amplified.

10. An amplifier circuit according to Claim 8, wherein the signal resistor comprises a pull-up resistor for initializing an operating state of a microphone, and wherein the second input of the differential amplifier is for connection to a microphone output.

11. An amplifier circuit according to Claim 8, further comprising an impedance matching stage having an input for receiving the reference voltage and an output connected to the first input of the differential amplifier.

12. A microphone comprising:
a signal output; and
an output signal amplifying circuit for amplifying a microphone output signal from the signal output and comprising
a differential amplifier having a first input for receiving a reference voltage and second input connected to the signal output,
a biasing resistor connected between the first and second inputs, and
a signal resistor connected between the first and second inputs and in parallel to the biasing resistor.

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MELLOT
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13. A microphone according to Claim 12, wherein the variations of a current passing through the signal resistor correspond to the microphone output signal.

14. A microphone according to Claim 12, wherein the signal resistor comprises a pull-up resistor for initializing an operating state of the microphone.

15. A microphone according to Claim 12, wherein output signal amplifying circuit further comprises an impedance matching stage having an input for receiving the reference voltage and an output connected to the first input of the differential amplifier.

16. A method of amplifying an output signal from an electret microphone, the output signal being represented by variations in a current passing through a pull-up resistor for initializing the operating state of the microphone, the method comprising the steps of:

connecting a first terminal of the pull-up resistor to an output of the microphone;

connecting a second terminal of the pull-up resistor to a first input of a differential amplifier; and

connecting the first terminal of the pull-up resistor to a second input of the differential amplifier.

17. A method of making an amplifier circuit comprising the steps of:

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Serial No. **Not Yet Assigned**
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providing a differential amplifier having a first input for receiving a reference voltage and second input for receiving a signal to be amplified;

connecting a biasing resistor between the first and second inputs; and

connecting a signal resistor between the first and second inputs and in parallel to the biasing resistor.

18. A method according to Claim 17, wherein the variations of a current passing through the signal resistor correspond to the signal to be amplified.

19. A method according to Claim 17, wherein the signal resistor comprises a pull-up resistor for initializing an operating state of a microphone, and wherein the second input of the differential amplifier is for connection to a microphone output.

20. A method according to Claim 17, further comprising the step of connecting an output of an impedance matching stage to the first input of the differential amplifier, the impedance matching stage having an input for receiving the reference voltage.

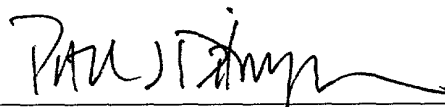
REMARKS

It is believed that all of the claims are patentable over the prior art. Accordingly, after the Examiner completes a thorough examination and finds the claims patentable, a Notice of Allowance is respectfully requested in due course.

In re Patent Application of
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Serial No. **Not Yet Assigned**
Filed: **Herewith**

Should the Examiner determine any minor informalities that need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number below.

Respectfully submitted,



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Attorney for Applicant

SIGNAL AMPLIFICATION CIRCUIT AND PROCESS FOR NEUTRALIZING NOISE FROM A POWER SUPPLY VOLTAGE

Field of the Invention

The present invention relates to the field of integrated circuits, and more particularly, to integrated circuits for amplification of a signal
5 received from a electret microphone and to a process for neutralizing noise in a microphone power supply voltage.

Background of the Invention

10 In many audio and video devices, an audio circuit includes an electret microphone and a low noise preamplifier into which a signal is input from a microphone. The preamplifier output signal may then be converted into a digital signal in an analog-digital
15 converter and then amplified, processed, filtered and possibly memorized or stored in this form.

Electret microphones must be polarized by a positive DC voltage through a pull-up resistor initializing the microphone operating state. The
20 microphone output signal, formed by a variable current, passes through this pull-up resistor so that the variable voltage at the terminals of this resistor is representative of the microphone output signal. One of the main problems with this type of audio circuit is

the lack of immunity of the useful microphone output signal to noise affecting the positive DC biasing voltage of the electret microphone.

One known method of correcting this problem is to filter the biasing voltage before applying it to the pull-up resistor. This filtering may be done for example using an R.C. circuit. This process is expensive because it requires the addition of an additional capacitor external to the integrated circuit, and also it is not very efficient, particularly at the low frequencies present in the audio range.

Summary of the Invention

An object of this invention is to neutralize noise in the biasing voltage of the electret microphone.

Any noise on the microphone biasing voltage is perceived as being a signal by the pull-up resistor initializing the position of the microphone, due to the way in which the microphone is connected and the fact that it is equivalent to a current source. Therefore, such noise is amplified by the low noise preamplifier (LNA). Although a differential structure is usually used for this preamplifier, it amplifies the noise in the biasing voltage.

An approach of the present invention is to correlate the microphone initialization voltage with the internal reference of the low noise amplifier or preamplifier. Consequently, the noise in this voltage is perceived as being a common mode noise on the preamplifier inputs and not a difference signal. In this way the noise is rejected, by difference, by the differential structure instead of being amplified.

Thus, the invention relates to a signal amplification circuit comprising an amplifier with a differential structure comprising two inputs. A first input receives a reference voltage and a second input
5 receives the signal to be amplified. The two inputs are connected to each other through a biasing resistor. The first input is also coupled to the second input through a signal resistor through which a current passes, the variations of which are representative of the signal to
10 be amplified.

The invention also relates to a process for neutralizing noise in an electret microphone power supply voltage. A microphone output signal is represented by the variations in a current passing
15 through a pull-up resistor initializing the microphone operating position. The power supply voltage is input to this pull-up resistor. The process includes coupling a first terminal of the pull-up resistor firstly to the microphone output and secondly to a second input of an
20 amplifier with a differential structure. The process further includes coupling a second terminal of the pull-up resistor to a first input to the amplifier with a differential structure.

25 **Brief Description of the Drawings**

The invention and its advantage compared with prior art will be better understood after reading the following description with regard to the attached drawings in which:

30 Figure 1 is a functional diagram of a prior art circuit; and

Figure 2 is a diagram of a circuit of an embodiment of the present invention.

Detailed Description of the Preferred Embodiments

Figure 1 shows a conventional circuit used for amplification of the output signal from a microphone 2. This signal is composed of a current produced by the microphone and developed in a pull-up and signal resistor 3, one connection of the resistor being connected to a microphone output 4. The other connection of resistor 3 is connected to a DC pull-up voltage VCC acting on the operating state of the microphone 2. This DC voltage is applied through a filter circuit composed of a resistor 15 and a capacitor 16. The output signal from the microphone 4 is connected to an input 9 to a differential structure amplifier 5. This amplifier has two inputs, a first 8 and a second 9, and two outputs, a first 6 and a second 7 known as the positive and negative outputs. A reference voltage is applied to the first input 8, and the signal to be amplified is applied to the second input 9, this signal being taken from the output 4 of microphone 2 through a filter capacitor 17. The two inputs 8 and 9 are connected to each other through a biasing resistor 10. In this type of system, it can be seen that any unfiltered noise from the pull-up DC voltage VCC is entirely transmitted to the pull-up resistor 3 and is therefore amplified by circuit 5.

Figure 2 shows a circuit 1 according to one embodiment of this invention. In this circuit, elements with the same function as the elements shown in figure 1 are represented with the same reference number. The circuit shown in figure 2 is different from the circuit shown in figure 1 because a reference voltage VREF is applied firstly to the first input 8 of the differential structure amplifier 5, and secondly to the pull-up and signal resistor 3 initializing the operating state of the microphone 2.

In the circuit shown in figure 2, this reference voltage is applied through an impedance matching circuit 11 comprising an input 12 and an output 13. The output 13 from this circuit 11 is applied firstly to the first input 8 of the amplification circuit 5, and secondly to a connection of the pull-up resistor 3. In the example shown in figure 2, the impedance matching circuit 11 is provided with an NPN transistor, the base 19 of which forms the input to the circuit and the emitter 13 of which forms the output. All elements shown in figure 2 are integrated on a chip except for the microphone 2 and the filter capacitor 17, the microphone 2 being connected through the connection 4 on the integrated circuit shown in figure 2.

THAT WHICH IS CLAIMED IS:

1. Signal amplification circuit (1), the circuit comprising a differential structure amplifier (5) comprising two inputs (8, 9), a first (8) and a second (9), a reference voltage being applied to the first input, and the signal to be amplified being applied to the second input, the two inputs being connected to each other through a biasing resistance (10), the circuit being characterized in that the first input (8) is also coupled to the second input (9) through a signal resistance (3) through which a current passes, the variations of which are representative of the signal to be amplified.

2. Circuit (1) according to claim 1, characterized in that the signal resistance (3) is a pull-up resistance (3) initializing the operating position of a microphone (2), the second input (9) of the amplifier (5) being designed to be connected to an output (4) from microphone (2).

3. Circuit (1) according to claim 1, characterized in that it comprises an impedance matching stage (11) comprising an input (12) and an output (13), the reference voltage being applied to the input (12) and the output (13) forming the first input (8) to the differential structure amplifier (5).

4. Process for neutralizing noise in an electret microphone (2) power supply voltage, an output signal from the microphone (2) being represented by variations in a current passing through a pull-up

5 resistance (3) initializing the operating position of
the microphone (2), the said power supply voltage being
applied to this pull-up resistance (3), the process
consisting of coupling a first terminal (4) of the
pull-up resistance (3) firstly to the output from the
10 microphone and secondly to a second input (9) to a
differential structure amplifier (5) and coupling a
second terminal of the said pull-up resistance (3) to a
first input (8) to the differential structure amplifier
(5).

**SIGNAL AMPLIFICATION CIRCUIT AND PROCESS FOR
NEUTRALIZING NOISE FROM A POWER SUPPLY VOLTAGE**

Abstract of the Disclosure

An amplification circuit is provided for the signal output from a microphone in which the signal is amplified by a differential structure amplifier. The
5 circuit includes the pull-up voltage, which initializes the operating state of the microphone, being coupled to a first input of the differential structure amplifier and to a second input of the differential structure amplifier through a pull-up resistor.

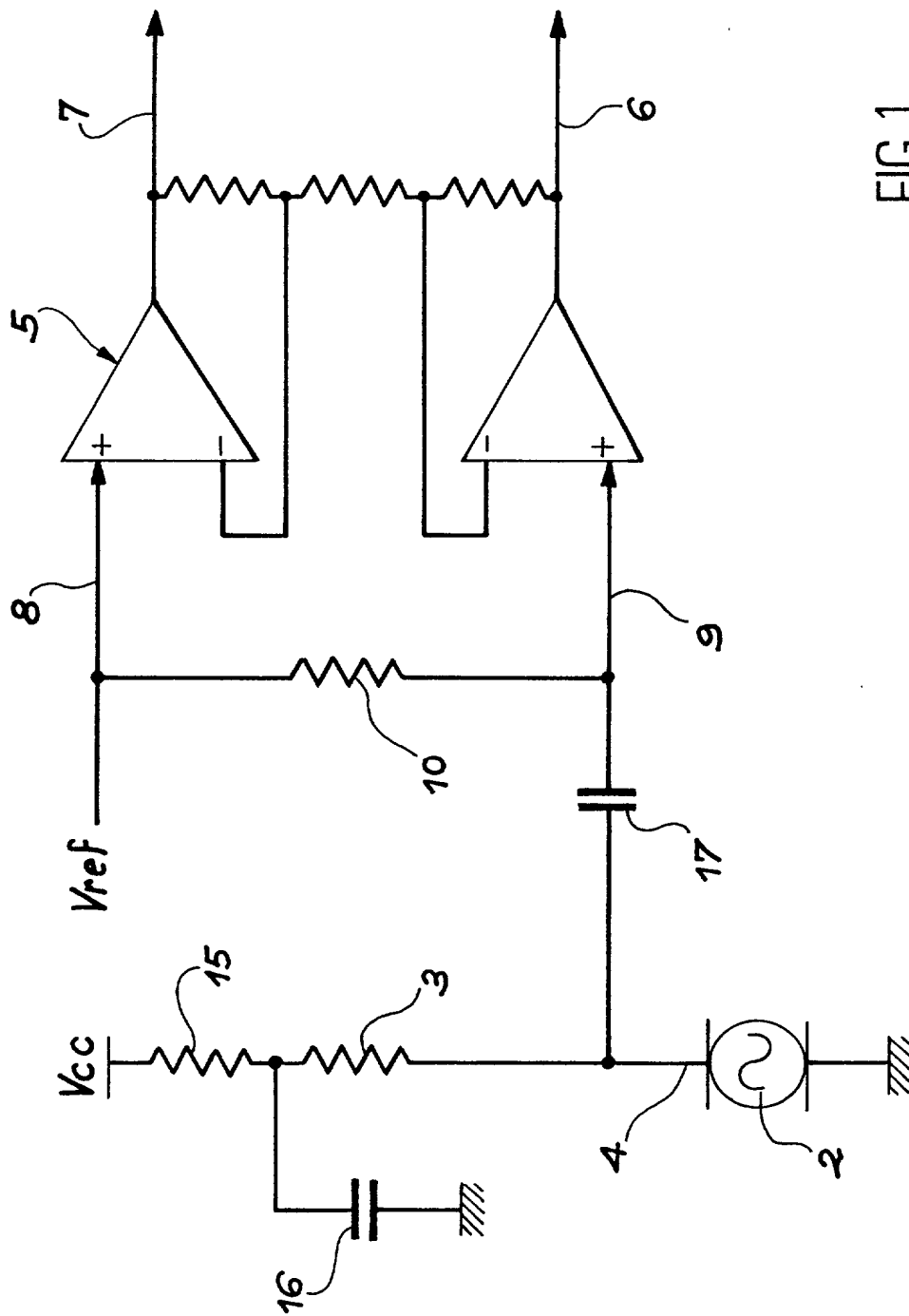


FIG.1

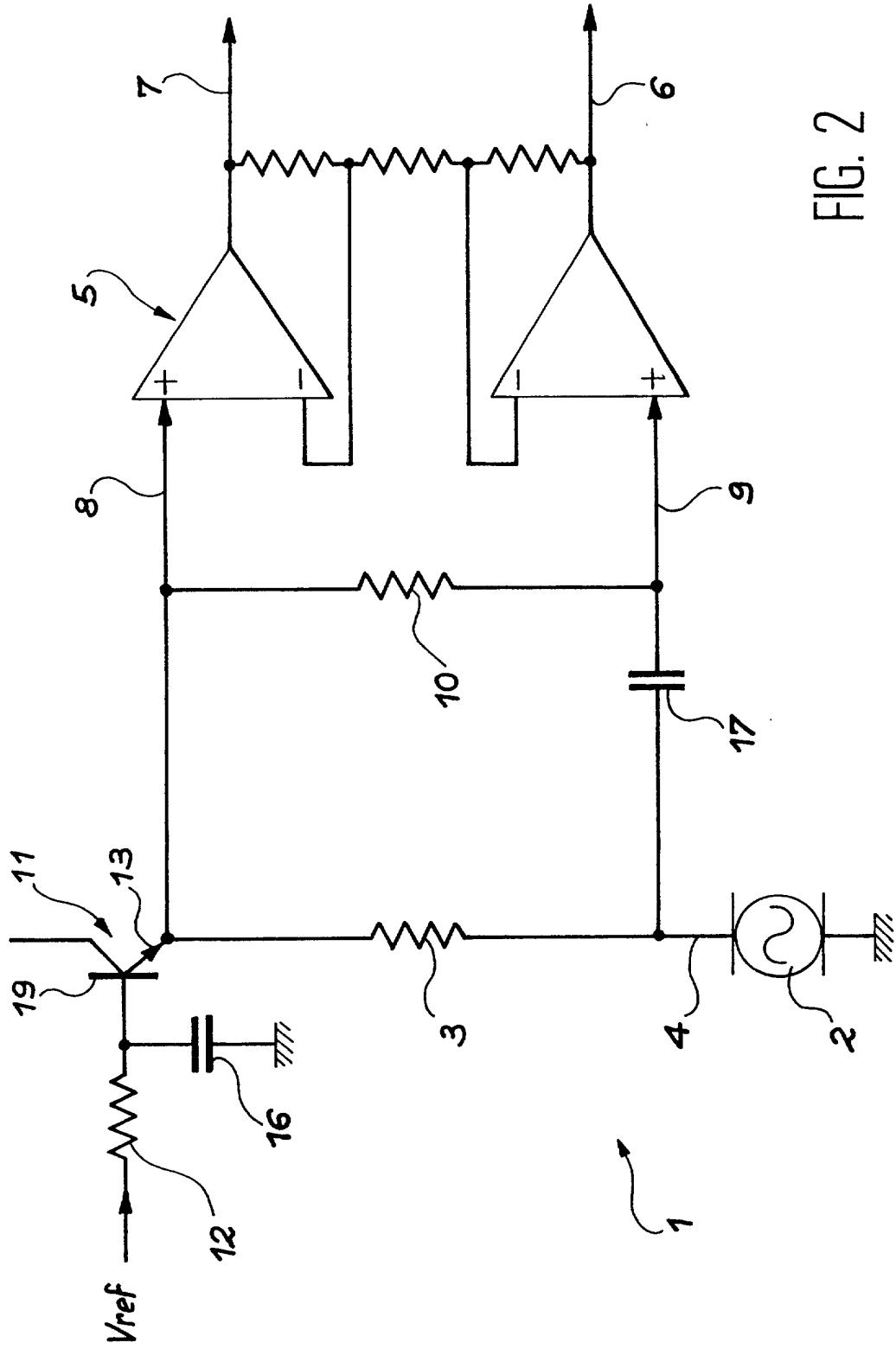


FIG. 2

Declaration, Power Of Attorney and Petition

Page 1 of 2

MELLOT Pascal

WE (I) the undersigned inventor(s), hereby declare(s) that :

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled : SIGNAL AMPLIFICATION CIRCUIT AND PROCESS FOR NEUTRALIZING NOISE FROM A POWER SUPPLY VOLTAGE.

the specification of which

☒ is attached hereto.

☐ was filed on

as Application Serial No.

and amended on

☐ was filed as PCT international application

Number

on

and was amended under PCT Article 19

on

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119 (a)-(d) or § 365 (b) of any foreign application(s) for patent or inventor's certificate, or § 365 (a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application (s)

Application No.	Country	Day/month/Year	Priority Claimed	
99 00946	FRANCE	28/01/1999	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
_____	_____	_____	<input type="checkbox"/> YES	<input type="checkbox"/> NO
_____	_____	_____	<input type="checkbox"/> YES	<input type="checkbox"/> NO
_____	_____	_____	<input type="checkbox"/> YES	<input type="checkbox"/> NO

We (I) hereby claim the benefit under Title 35, United States Code, § 119 (e) of any United States provisional application(s) listed below.

(Application Number)

(Filing Date)

(Application Number)

(Filing Date)

We (I) hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of prior application and the national or PCT International filing date of this application.

Application Serial No.

Filing Date

Status (pending, patented,
abandoned)

And we (I) hereby appoint : Christopher F. REGAN N°34.906; Herbert L. ALLEN REG. N° 25.322; David L. SIGALOW REG. N° 36.006; Jeffrey S. WHITTLE REG. N° 36.382; Richard K. WARTHER REG. N° 32.180; Michael W. TAYLOR REG. N° 43.182; Carl M. NAPOLITANO REG. N° 37.405 and Jacqueline E. HARTT REG. N° 37.845.; our (my) attorneys, with full powers of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to the firm of ALLEN, DYER, DOPPELT, MILBRATH & GILCHRIST, P.A. : 1401 Citrus Center, 255 South Orange Avenue, P.O. BOX 3791, ORLANDO, FLORIDA 32802-3791 (U.S.A.)

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true ; and future that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardise the validity of the application or any patent issuing thereon.

MELLOT Pascal

NAME OF FIRST SOLE INVENTOR

Signature of Inventor

December 08, 1999
Date

Residence : 108, Chemin du
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Citizen of : FRANCE

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In re Patent Application of:
MELLOT

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) Eric Link
) (SIGNATURE OF PERSON MAILING PAPER OR FEE)

SUBMISSION OF PROPOSED MODIFICATIONS TO DRAWINGS

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Submitted herewith is a request for a proposed
drawing modification to label FIG. 1 prior art as indicated in
red ink.

Respectfully submitted,

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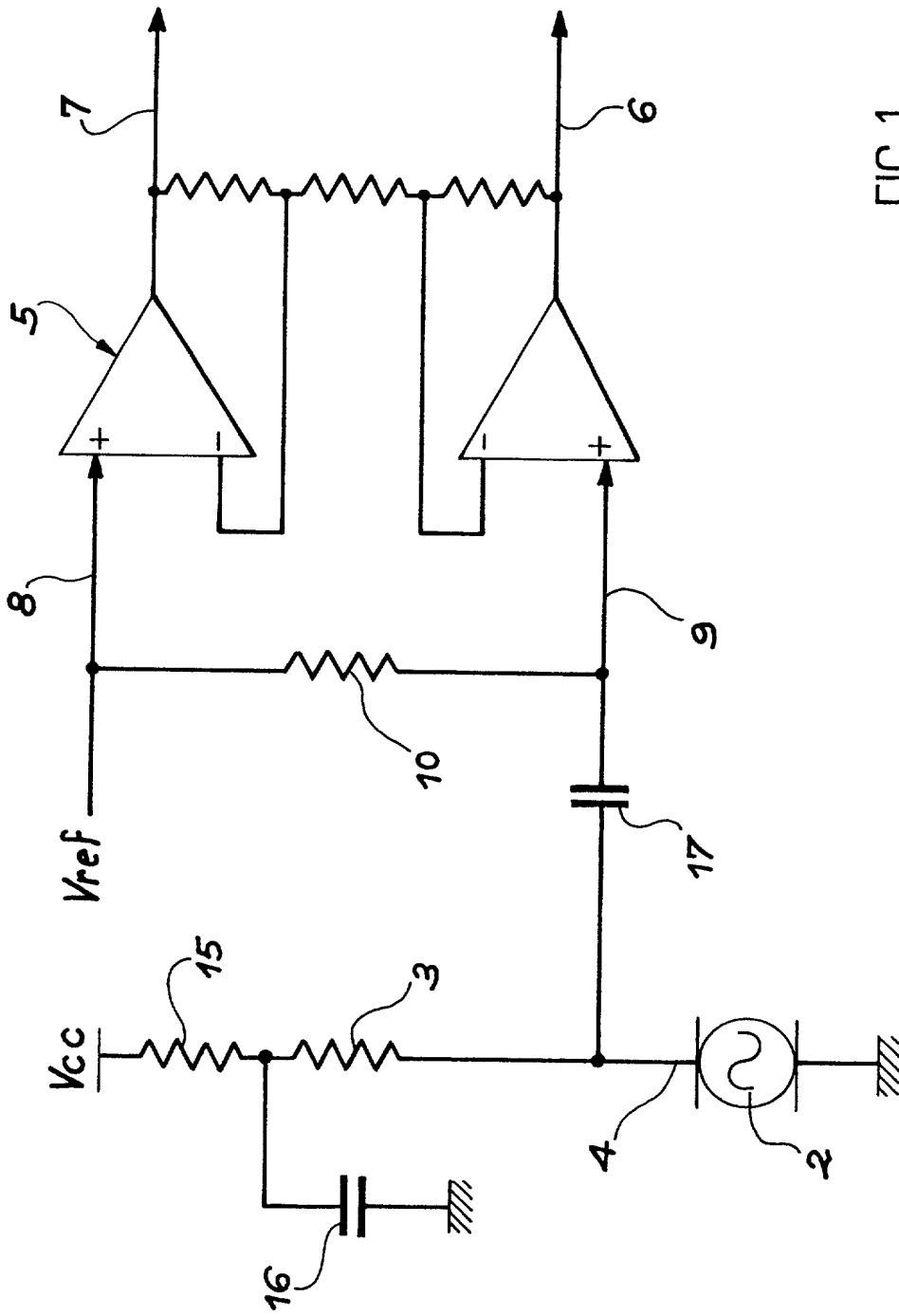


FIG. 1
Prior Art